DETECTING ORGANIC MOLECULES ON THE SURFACE OF INORGANIC DUST PARTICLES USING AEROSOL MASS SPECTROMETRY

by

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ABSTRACT

Detecting Organic Molecules on the Surface of Inorganic Dust Particles Using Aerosol Mass Spectrometry

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Detection of organic molecules present on the surface of dust particles is important in homeland security, agriculture, and several other applications. The research presented reports the ability of the aerosol mass spectrometer (AMS) to detect molecules on the surface of dust particles without detecting the particle core.

Experiments were carried out to detect semi-volatile organic compounds adsorbed onto the surface of particulates without interference from the dust particle core. Methyl salicylate, oleic acid, and organophosphorus pesticides such as Malathion were detected on the surface of particles representative of dust-type materials. Zeolite powders were used as aerosol support, representative of a typical silica mineral aerosol present in the atmosphere. Mass spectral fingerprint information was gained by first directly detecting atomized species to record their clean electron impact mass spectrum. This facilitated detection during later experiments of organic molecules coated on an inorganic support.

Spectra obtained give mass spectrometric signatures of molecules coated on inorganic particles without detection of the particle core.

An important feature of the AMS is the ability to equate an ion rate detected in the mass spectrometer to a mass concentration of a given chemical species in a sample using its ionization efficiency. Based on an average inlet flow rate of 1.2 cm^3 sec^{-1}, the ionization efficiencies obtained were $5.89x10^{-5}$, $1.15x10^{-6}$, and $1.62x10^{-5}$ for Malathion, methyl salicylate, and oleic acid, respectively. These experiments and the results obtained show that detection and characterization of organic species adsorbed onto inorganic dust particles are possible at μg m^{-3} concentrations using the AMS.

(93 pages)

DEDICATION

My Lord and Savior Jesus Christ, the author of life itself, without whom life would have been an unending search for meaning and the beloved memory of my dad.

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